(54) ATF EXCHANGE DEVICE
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(71) MK SEIKO CO LTD (72) SATOSHI SHIROYAMA(1)
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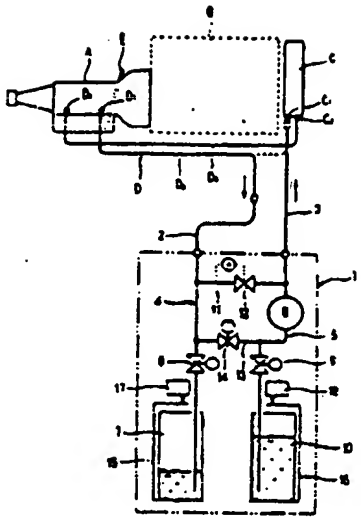
PURPOSE: To enable safe and accurate exchange work to be performed by constituting a device controlling an adjusting means and a forced feed means in a manner wherein a difference between supply and discharge amounts of oil is generated within a predetermined range.

CONSTITUTION: An automatic transmission oil (ATF) exchanger device 1 is connected to an ATF flow line D, connected to an oil cooler of a radiator C, through a discharge oil hose 2 and a supply oil hose 3. The ATF flow line D reaches a flow inlet C_1 of the oil cooler from an ATF flow outlet D_1 of an automatic transmission A through a hose D_2 and an ATF flow inlet D_4 of the automatic transmission A from a flow outlet C_2 of the oil cooler through a hose D_3. A discharge oil pipe line 4 communicates with a discharge oil tank 7 through a solenoid valve 6, extracting an inflow of old ATF into the discharge oil hose 2 from the ATF flow line D to the waste oil tank 7. A supply oil pipe line 5 communicates with a new oil tank 10 through a pump 8 and a solenoid valve 9, and new ATF, stored in the new oil tank 10, is pressurized by the pump 8 and forced to be fed to the ATF flow line D from the supply oil hose 3.



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⑤発明の名称 ATF交換装置

⑳特 願 昭63-222800

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明細書

1．発明の名称

ATF交換装置

2．特許請求の範囲

(1)自動車のオイルクーラもしくはオイルクーラに接続するATF流路に接続する手段と、自動車のエンジン作動に伴い該接続手段を介して流入する古いATFを抜き取る排油管路と、該排出管路の開閉または流量調節により古いATFの流出を調整する手段と、排油管路より抜き取られる古いATFの量を検出する手段と、ポンプ等の圧送手段を備え新しいATFを圧送する給油管路と、該給油管路より圧送される新しいATFの量を検出する手段と、前記両検出手段で与える排油量と給油量とに基づき、排油量と給油量との差が所定の範囲内にあるよう前記調整手段および前記圧送手段を制御する手段とを備えたことを特徴とするATF交換装置。

(2)請求項(1)記載のATF交換装置において、排油管路で抜き取られた古いATFを貯える廃油タンクと、該廃油タンクの重量を検知する手段とを備え、排油量の検出手段では排油タンクの重量変化により排油量を検出すると共に、給油管路より圧送する新しいATFを貯える新油タンクと、該新油タンクの重量を検知する手段とを備え、新油量の検出手段では新油タンクの重量変化により給油量を検出することを特徴とするATF交換装置。

(3)請求項(1)記載のATF交換装置において、調整手段の上流に位置する排油管路部と、圧送手段の下流に位置する給油管路部とを接続する短絡流路を設け、該短絡流路には排油管路におけるATFの流出圧が所定以上に達すると開弁して給油管路側へ流通させる弁手段を備えたことを特徴とするATF交換装置。

3．発明の詳細な説明

[産業上の利用分野]

この発明は、自動車の自動変速機に使用されるATF(自動変速機油)の交換を行なう装置に関し、にオイルクーラもしくはオイルクーラに接続するATF流路と接続して交換を行なうタイプの装

置に関する。

〔従来技術〕

従来、この種の装置として例えば実公昭62-22718号公報に記載のものが知られている。すなわち、オイルクーラに接続するＡＴＦ流路と接続し、エンジン作動に伴ってＡＴＦ流路より排出される古いＡＴＦを抜き取り、同時にＡＴＦ流路へ新しいＡＴＦを圧送して、自動変速機内のＡＴＦをほぼ全容量にわたって交換できる装置が提案されている。

〔解決しようとする問題点〕

ところで、こうした従来の装置においては、排出される古いＡＴＦおよび給油する新しいＡＴＦの流量をそれぞれに手作業で調節しなければならず、作業が面倒であるばかりか、作業者にある程度の熟練を必要としていた。また、排出されるＡＴＦの流はエンジンの回転数に応じて変動する上、排油量と給油量とを正確に把握する手段を有していないから、排油量と給油量との平衡を保つことが困難で、作業中に自動変速機内のＡＴＦレベルを過度に低下させてしまったり、ＡＴＦのオーバーフローを招いてしまったりする不都合があった。特に、自動変速機のＡＴＦレベルが過度に低下すると、ＡＴＦ内に空気が混入し、自動変速機内に付着・沈殿していたスラッジを巻き上げてストレーナの目詰まりを生じたり、自動変速機の機能を低下させる危険がある。

〔問題点を解決するための手段〕

従ってこの発明は自動車のオイルクーラもしくはオイルクーラに接続するＡＴＦ流路に接続する手段と、自動車のエンジン作動に伴い該接続手段を介して流入する古いＡＴＦを抜き取る排油管路と、該排出管路の開閉または流量調節により古いＡＴＦの流出を調整する手段と、排油管路より抜き取られる古いＡＴＦの量を検出する手段と、ポンプ等の圧送手段を備え新しいＡＴＦを圧送する給油管路と、該給油管路より圧送される新しいＡＴＦの量を検出する手段と、前記両検出手段で与える排油量と給油量とに基づき、排油量と給油量との差が所定の範囲内にあるよう前記調整手段および前記圧送手段を制御する手段とを備えて、排油量と給油量を所定の範囲で自動的に平衡させ、上記問題点の解決をはかったものである。

また、この発明は、排油管路で抜き取られた古いＡＴＦを貯える廃油タンクと、該廃油タンクの重量を検知する手段とを備え、排油量の検出手段では排油タンクの重量変化により排油量を検出すると共に、給油管路より圧送する新しいＡＴＦを貯える新油タンクと、該新油タンクの重量を検知する手段とを備え、新油量の検出手段では新油タンクの重量変化により給油量を検出するように構成すれば、より確実な交換ができる。

更に、調整手段の上流に位置する排油管路部と、圧送手段の下流に位置する給油管路部とを接続する短絡流路を設け、該短絡流路には排油管路におけるＡＴＦの流出圧が所定以上に達すると開弁して給油管路側へ流通させる弁手段を備えて、より安全に作業を行なえる構成とすることができる。

尚、下記実施例において、接続手段は排油ホース２に、調整手段は電磁弁６に、圧送手段はポンプ８に、制御手段は制御ボート20にそれぞれ相当する。

〔実施例〕

以下、その具体例を図面を基に説明する。

第１図は本発明一実施例の構成ならびにその接続状態を説明する図で、１はＡＴＦ交換装置、Ａは該装置１によりＡＴＦの交換を受ける自動変速機、Ｂはエンジン、Ｃはオイルクーラを内蔵したラジエータである。

ＡＴＦ交換装置１は、それぞれ接続アダプターを備えた排油ホース２および給油ホース３を介して、ラジエータＣのオイルクーラに接続するＡＴＦ流路Ｄと接続している。ＡＴＦ流路Ｄは、自動変速機ＡのＡＴＦ流出口D_1からホースD_2を介してオイルクーラの流入口C_1へ至り、オイルクーラの流出口C_2からホースD_3を介して自動変速機ＡのＡＴＦ流入口D_4へ至っており、このうちいずれかの個所で流路の接続を断ち、上流側を排油ホース２に下流側を給油ホース３に接続すれば良い。尚、給油ホース３は、その先端に細径のノズルホース

を接続し、これを自動変速機のフィラーチューブEより挿入して 油するようセットすることもできる。

ATF装置1内には、排油ホース2と連通して排油管路4が、また給油ホース3と連通して給油管路5が形成されている。排油管路4は、電磁弁6を介して排油タンク7と連通し、前記ATF流路Dより排油ホース2内へ流入する古いATFを廃油タンク7へ抜き取る。給油管路5は、ポンプ8および電磁弁9を介して新油タンク10と連通し、新油タンク10に貯える新しいATFをポンプ8により加圧し、給油ホース3からATF流路Dへ圧送する。

11は排油管路4の電磁弁6上流側と給油管路5のポンプ8下流側とを接続する第1の短絡流路で、電磁弁6が閉弁状態となり排油管路4へのATF流入圧が通常より高圧になると、開弁して給油側へATFを流通させ循環させるリリーフ弁12を備えている。

13は排油管路4の電磁弁6上流側と給油管路5のポンプ8上流側とを接続する第2の短 流路で、電磁弁14を備え、廃油タンク7内の廃油を廃棄したい場合に、電磁弁14を開くと共にポンプ8を駆動して、給油ホース3より廃油を排出させることができる。

廃油タンク7と新油タンク10とは、それぞれ支持台15・16に載置されており、この支持台15・16の支持部にはそれぞれロードセルを備えた重量検知器17・18が設けられている。

第2図は上記実施例の制御系を示すブロック図で、20は制御ボード、21はリレーボード、22は操作パネルである。

制御ボード20は、入出力回路23、CPU24およびメモリ25を備え、メモリ25に書き込まれたプログラムに従い操作パネル22および重量検知器17・18からの入力信号に応じてリレーボード21へ制御出力し、前記ポンプ8および各電磁弁6・9・14を作動させる。

操作パネル22は、表示部26と操作入力部27とから成っている。表示部26には、設定量表示器27、給油量表示器28およびモニターランプ29が備えられ、それぞれ以下の表示に使用される。

設定量表示器27：後述のプリセットキー30で設定されたATF交換量を表示する。

給油量表示器28：ATF交換作業および後述の注入キー32による注入作業に伴い、給油された新しいATFの量を表示する。尚、後述の抜取キー33が押された時は、抜き取ったATFの量を表示する。

モニターランプ29：廃油タンク7の満タンおよび新油タンク10における貯油不足が検知されると点灯してこれを報知する。

操作入力部27には、プリセットキー30、スタートキー31、注入キー32、抜取キー33、廃油排出キー34および停止キー35が備えられ、それぞれ以下の操作に使用される。

プリセットキー30：前記設定量表示器27の表示を見ながらATFの交換量を設定するもので、下限値(4ℓ)から上限値(12ℓ)まで1ℓ刻みで設定できる。

スタートキー31：ATF交換の開始入力を行なうもので、入力後プリセットキー30で設定された量の交換が成されるまで自動動作する。尚、プリセットキー30での設定が成されないまま押されると、標準量(8ℓ)の交換が自動的に行なわれる。

注入キー32／抜取キー33：ATF交換後、自動変速機内のレベルチェックをし、その結果に応じてATFの注入および抜取を行なうもので、キー入力により注入または抜取の作業を開始し、停止キー35を押すことによりこの作業を停止することができる。

廃油排出キー34：排油タンク7内の廃油を給油ホース3より排出させるもので、キー入力により排出を開始し、停止キー35を押すことによりこの排出を停止することができる。

第3図は上記実施例によるATF交換時の動作を示すフローチャートで、以下この図を基に実施例の動作を説明する。

排油ホース2および給油ホース3を自動変速機のATF流路Dへ 続し、エンジンを始動させる

と共に、操作パネル22においてプリセットキー30で交換量Qp(4～12ℓ)を設定し、スタートキー31を押すと図示のフローを実行する。

まず、プリセットキー30で設定された交換量をメモリQpへ読み込み(1)、続いて重量検知器17より廃油タンク7の初期重量をメモリW₁へ、また重量検知器18より新油タンク10の初期重量をメモリW₂へそれぞれ読み込む(2)。

ここで、読み込んだ廃油タンクの初期重量W₁と設定値Qpに基づき、交換終了時の廃油タンクの予想重量W₁+αQp(αはATFの比重)を求め、この重量が廃油タンク7の満タン時の重量Wf以上であるか否かをチェックし(3)、Wf以上であれば前記モニターランプ29に廃油満タンが生じて設定値の交換ができないことを点灯して表示して(4)、フローを終了する。この場合、作業者は廃油タンク7の交換もしくは廃油の排出をして再度操作入力を行なえば良い。

廃油満タンの心配がなければ、更に、新油タンクの初期重量W₂と設定量Qpに基づき、交換終了時の新油タンクの予想重量W₂−αQp(αはATFの比重)を求め、この重量が新油タンク10の空状態での重量We以下であるか否かをチェックし(5)、We以下であればモニターランプ29に新油不足となって設定量の交換ができないことを点灯表示して(6)、フローを終了する。この場合は、新油タンク10に新油を補充するか、新油の入ったタンクと交換して、再度スタート操作すれば良い。

新油不足の心配もないと分かると、ポンプ8を駆動すると共に電磁弁6・9を開いて交換作業を開始する(7)。これに伴い排油ホース4からは自動変速機内の古いATFが流入し廃油タンク7に貯えられ、同時に給油ホース3からは新油タンク10内の新しいATFが圧送される。

交換開始後、重量検知器17より廃油タンク7の現在重量をメモリW₁へ、また重量検知器18より新油タンク10の現在重量をメモリW₂へそれぞれ読み込み(8)、この現在重量W₁・W₂に基づいて抜き取られた排油量(W₁−W₁)／αおよび給油量(W₂−W₂)／αを求め、それぞれメモリQ₁・Q₂へ記憶し(9)、このうち給油量Q₂を給油量表示器28へ表示する(10)。

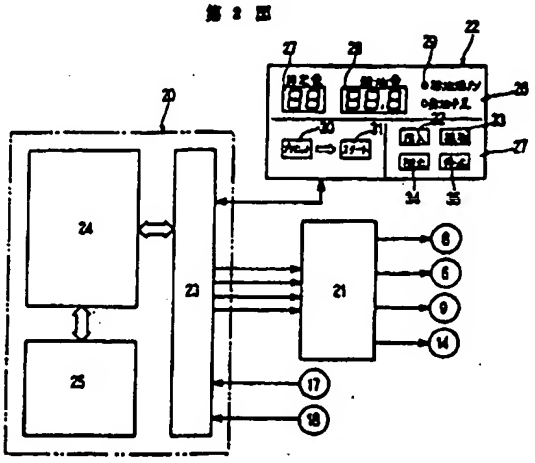
続いて、求めた排油量Q₁と給油量Q₂に基づき、その差Q₁−Q₂が所定値α(0～0.5ℓ)を越えているか、または所定値b(0～−0.5ℓ)を下回っているかをチェックし(11)・(12)、aを越えていればポンプ8を運転状態に保持する一方で電磁弁6を閉じて給油を先行させ(13)、bを下回っていれば電磁弁6は開いたままでポンプ8を停止して排油を先行させる(14)。また、排油量Q₁と給油量Q₂が所定範囲b<Q₁−Q₂<aにあってほぼ平衡していれば、ポンプ8を運転状態に、電磁弁6を開弁状態に維持する(15)。尚、エンジン・アイドリング時の排油量よりポンプ8による給油量の方が上回るよう設定されているので、通常はステップ(13)の状態に至ることはない。

こうして交換が進行し、排油量Q₁が設定量Qpに達すると(16)、電磁弁6を閉じ(17)、また給油量Q₂がやはり設定量Qpに達すると(18)、ポンプ8を停止する(19)。こうして排油量Q₁と給油量Q₂がいずれも設定量Qpに達し、交換が終了したと判断されると(20)、電磁弁9も閉じて(21)一連の動作を終了する。

この後、作業者は自動変速機のATFレベルをチェックし、必要に応じて注入キー32もしくは抜取キー33を操作してレベルを調整した後エンジンを止め、排油ホース2と給油ホース3を外してATF配管を元通りに接続し、交換作業を終了する。

従って、この実施例によれば、排油ホース2と給油ホース3をATF配管Dに接続し、キー入力を行なうだけで、設定量のATF交換を自動的に行ない、従来のように煩わしい手作業を要することがなく、慣れない作業者でも容易に作業を完遂することができる。また、排油量と給油量が常に監視され、その差が所定範囲より逸脱すると、電磁弁6もしくはポンプ8の動作制御により、いずれかが極端に先行しないよう平衡操作するので、自動変速機においてATFに空気を混入させたり、オーバーフローを招く心配がない。更に、排出される古いATFはエンジンの駆動により加熱され

第2図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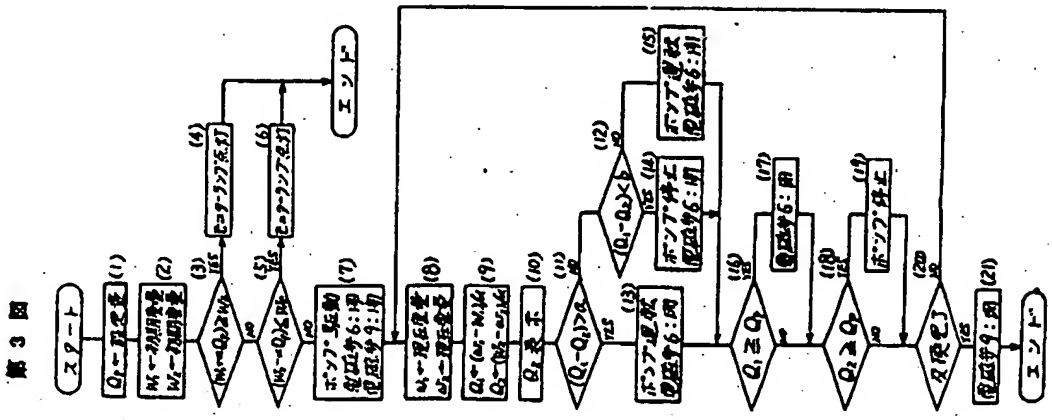
第3図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膨張した状態で廃油タンク7にもたらされるのに対し、給油される新しいＡＴＦは常温のまま送られるので、両者の体積量が等しくなるよう交換すると、当初の自動変速機内のＡＴＦレベルをかなり上回るレベルの給油をしてしまうこととなるが、本実施例では重量検知器17・18による重量データに基づいて交換するので、正確に同量の交換ができる。更にまた、前記第１の短絡流路11を設けて、交換中に電磁弁６が閉じられて排油管路４やＡＴＦ流路Ｄの圧力が上昇しても、リリーフ弁12が開いてＡＴＦを循環させるので、高圧により各管路に疲労を与えたり、自動変速機のオイルポンプに過負荷を与える等の危険がない。

〔発明の効果〕

この発明は以上のように構成されるもので、以下のような効果を奏する。

請求項(1)に関して；従来のように手作業で流量調節をする必要がなく作業が簡単で、作業者に熟練を要することもない。また、排油量と給油量とは所定の範囲で平衡に保たれるから、自動変速機でＡＴＦ内に空気の混入を生じたり、オーバーフローを招く心配がなく、安全で且つ正確な交換作業ができる。

請求項(2)に関して；排油量と給油量はその重量に基づいて検出されるから、温度による体積変化の影響を受けることがなく、常に正確な量の交換ができる。

請求項(3)に関して；調整手段により排油が制限され管路内が高圧になっても、短絡流路によりこれを解放できるから、管路に疲労を与えたり自動変速機のオイルポンプに過負荷を加えることがなく、安全に交換作業が行なえる。

４．図面の簡単な説明

第１図は本発明一実施例の構成説明図。

第２図は同実施例の制御系を示すブロック図。

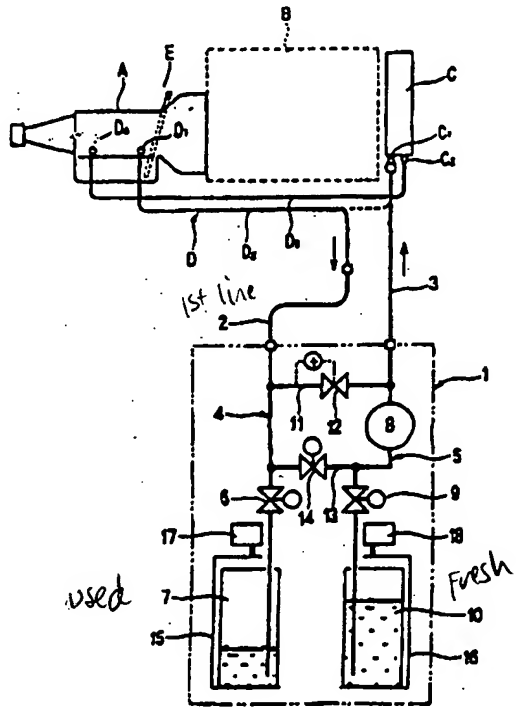
第３図は同実施例の動作を示すフローチャート。

１はＡＴＦ交換装置、２は排油手段たる排油ポース、４は排油管路、５は給油管路、６は調整手段たる電磁弁、７は排油タンク、８は圧送手段たるポンプ、10は新油タンク、11は短絡流路、12は弁手段たるリリーフ弁、17・18は重量検知手段たる重量検知器、20は制御手段たる制御ボード、Ａは自動変速機、Ｂはエンジン、Ｃはオイルクーラを内蔵したラジエータ、ＤはＡＴＦ流路。

特許出願人
エムケー精工株式会社

Solenoid is electrically controllable

第１図



手続補正書(自発)

昭和63年 9月 12日

特許庁長官 殿

1．事件の表示
63-222800
昭和63年9月6日付提出の特許願

2．発明の名称
ＡＴＦ交換装置

3．補正をする者
事件との関係 特許出願人
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4．補正の対象
明細書

5．補正の内容
別紙の通り

特許庁 63.9.13 出願第二課

明 細 書

1．発明の名称
ＡＴＦ交換装置

2．特許請求の範囲
(1)自動車のオイルクーラもしくはオイルクーラに接続するＡＴＦ流路に接続する手段と、自動車のエンジン作動に伴い該接続手段を介して流入する古いＡＴＦを抜き取る排油管路と、該排出管路の開閉または流量調節により古いＡＴＦの流出を調整する手段と、排油管路より抜き取られる古いＡＴＦの量を検出する手段と、ポンプ等の圧送手段を備え新しいＡＴＦを圧送する給油管路と、該給油管路より圧送される新しいＡＴＦの量を検出する手段と、前記両検出手段で与える排油量と給油量とに基づき、前記調整手段および前記圧送手段を制御する手段とを備えたことを特徴とするＡＴＦ交換装置。
(2)請求項(1)記載のＡＴＦ交換装置において、排油管路で抜き取られた古いＡＴＦを貯える廃油タンクと、該廃油タンクの重量を検知する手段とを備え、排油量の検出手段では排油タンクの重量変化により排油量を検出すると共に、給油管路より圧送する新しいＡＴＦを貯える新油タンクと、該新油タンクの重量を検知する手段とを備え、新油量の検出手段では新油タンクの重量変化により給油量を検出することを特徴とするＡＴＦ交換装置。
(3)請求項(1)記載のＡＴＦ交換装置において、調整手段の上流に位置する排油管路部と、圧送手段の下流に位置する給油管路部とを接続する短絡流路を設け、該短絡流路には排油管路におけるＡＴＦの流出圧が所定以上に達すると開弁して給油管路側へ流通させる弁手段を備えたことを特徴とするＡＴＦ交換装置。

3．発明の詳細な説明
[産業上の利用分野]
この発明は、自動　の自動変速機に使用されるＡＴＦ(自動変速機油)の交換を行なう装置に関し、特にオイルクーラもしくはオイルクーラに接続するＡＴＦ流路と接続して交換を行なうタイプの装置に関する。

[従来技術]
従来、この種の装置として例えば実公昭62-22718号公報に記載のものが知られている。すなわち、オイルクーラに接続するＡＴＦ流路と接続し、エンジン作動に伴ってＡＴＦ流路より排出される古いＡＴＦを抜き取り、同時にＡＴＦ流路へ新しいＡＴＦを圧送して、自動変速機内のＡＴＦをほぼ全容量にわたって交換できる装置が提案されている。

[解決しようとする問題点]
ところで、こうした従来の装置においては、出される古いＡＴＦおよび給油する新しいＡＴＦの流量をそれぞ に手作業で調節しなければならず、作業が面倒であるばかりか、作業者にある程度の熟練を必要としていた。また、排出されるＡＴＦの量はエンジンの回転数に応じて変動する上、排油量と給油量とを正確に把握する手段を有していないから、　油量と給油量との平衡を保つことが困難で、作業中に自動変速機内のＡＴＦレベルを過度に低下させてしまったり、ＡＴＦのオーバ

ーフローを招いてしまったりする不都合があった。特に、自動変速機のＡＴＦレベルが過度に低下すると、ＡＴＦ内に空気が混入し、自動変速機内に付着・沈殿していたスラッジを巻き上げてストレーナの目詰まりを生じたり、自動変速機の機能を低下させる危険がある。

〔問題点を解決するための手段〕

従ってこの発明は、自動車のオイルクーラもしくはオイルクーラに接続するＡＴＦ流路に接続する手段と、自動車のエンジン作動に伴い該接続手段を介して流入する古いＡＴＦを抜き取る排油管路と、該排出管路の開閉または流量調節により古いＡＴＦの流出を調整する手段と、排油管路より抜き取られる古いＡＴＦの量を検出する手段と、ポンプ等の圧送手段を備え新しいＡＴＦを圧送する給油管路と、該給油管路より圧送される新しいＡＴＦの量を検出する手段と、前記両検出手段で与える排油量と給油量とに基づき、調整手段および前記圧送手段を制御する手段とを備えて、排油量と給油量を所定の範囲で自動的に平衡させ、上記問題点の解決をはかったものである。

また、この発明は、　油管路で抜き取られた古いＡＴＦを貯える廃油タンクと、該廃油タンクの重量を検知する手段とを備え、排油量の検出手段では排油タンクの重量変化により排油量を検出すると共に、給油管路より圧送する新しいＡＴＦを貯える新油タンクと、該新油タンクの重量を検知する手段とを備え、新油量の検出手段では新油タンクの重量変化により給油量を検出するように構成すれば、より確実な交換ができる。

更に、調整手段の上流に位置する排油管路部と、圧送手段の下流に位置する給油管路部とを接続する短絡流路を設け、該短絡流路には排油管路におけるＡＴＦの流出圧が所定以上に達すると開弁して給油管路側へ流通させる弁手段を備えて、より安全に作業を行なえる構成とすることができる。

尚、下記実施例において、接続手段は排油ホース２に、調整手段は電磁弁６に、圧送手段はポンプ８に、制御手段は制御ボート20にそれぞれ相当する。

〔実施例〕

以下、その具体例を図面を基に説明する。

第１図は本発明一実施例の構成ならびにその接続状態を説明する図で、１はＡＴＦ交換装置、Ａは該装置１によりＡＴＦの交換を受ける自動変速機、Ｂはエンジン、Ｃはオイルクーラを内蔵したラジエータである。

ＡＴＦ交換装置１は、それぞれ接続アダプターを備えた排油ホース２および給油ホース３を介して、ラジエータＣのオイルクーラに接続するＡＴＦ流路Ｄと接続している。ＡＴＦ流路Ｄは、自動変速機ＡのＡＴＦ流出口D_1からホースD_2を介してオイルクーラの流入口C_1へ至り、オイルクーラの流出口C_2からホースD_3を介して自動変速機ＡのＡＴＦ流入口D_4へ至っており、このうちいずれかの個所で流路の接続を断ち、上流側を排油ホース２に下流側を給油ホース３に接続すれば良い。尚、給油ホース３は、その先端に逆圧のノズルホースを　続し、これを自動変速機のフィラーチューブＥより挿入して給油するようセットすることもできる。

ＡＴＦ装置１内には、排油ホース２と連通して排油管路４が、また給油ホース３と連通して給油管路５が形成されている。排油管路４は、電磁弁６を介して排油タンク７と連通し、前記ＡＴＦ流路Ｄより交換ホース２内へ流入する古いＡＴＦを廃油タンク７へ抜き取る。給油管路５は、ポンプ８および電磁弁９を介して新油タンク10と連通し、新油タンク10に貯える新しいＡＴＦをポンプ８により加圧し、給油ホース３からＡＴＦ流路Ｄへ圧送する。

11は排油管路４の電磁弁６上流側と給油管路５のポンプ８下流側とを接続する第１の短絡流路で、電磁弁６が閉弁状態となり排油管路４へのＡＴＦ流入圧が通常より高圧になると、開弁して給油側へＡＴＦを流通させ循環させるリリーフ弁12を備えている。

13は　油管路４の電磁弁６上流側と　油管路５のポンプ８上流側とを接続する第２の短絡流路で、電磁弁14を備え、廃油タンク７内の廃油を循環し

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TRANSLATION from Japanese
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CERTIFICATE OF ACCURACY

State of New York }
} s.s.:
County of New York }

This day personally appeared before me Michael Newton who after being duly sworn deposes and states:

that (s)he is a translator of the J a p a n e s e and English languages, associated with BERTRAND LANGUAGES INC., 370 Lexington Avenue, New York, New York;

that (s)he is thoroughly familiar with these languages and has carefully made and verified the within translation from the original document in the J a p a n e s e language; and

that the within translation is a true and correct English version of such original to the best of his(her) knowledge and belief.

Japanese Patent 2-72299.

Michael C Newton

Sworn to before me
this 7 day of Nov. 1997

MARGARET V. ROACH
NOTARY PUBLIC
My Commission Expires Jan 3, 2003

Margaret V Roach

Translation from Japanese
Ref.# 11-09

(19) Patent Office of Japan (JP)
(11) Publication of Patent Application
(12) Publication of Laid-Open Patent (A) 2-72299
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F 01 M 11/04	Z	7312-3G

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(54) **Title of Invention**
Automatic Transmission Fluid Replacement Apparatus

(21) Application No. 63-222800
(22) Application Date: September 6, 1988

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Specification

1. Title of Invention
   Automatic Transmission Fluid Replacing Apparatus

2. Claim

(1) An automatic transmission fluid replacement apparatus which is equipped with a means which connects to the oil cooler of an automobile or to the automatic transmission fluid line which connects to the oil cooler; a fluid draining tube which removes the used automatic transmission fluid which flows via said connecting means as the engine of the automobile runs; a means which controls the opening and closing of said fluid draining tube or the outflow of used automatic transmission fluid by adjusting the flow rate; a means which detects the amount of used automatic transmission fluid which is removed from the fluid draining tube; a fluid supply line which is equipped with a pump or other pressurization means which pressurizes and circulates the new automatic transmission fluid; a means which detects the amount of fresh automatic transmission fluid which is pressurized from said fluid supply tube; and a means which controls the aforementioned control means and pressurization means so that the difference between the amount of fluid drained and the amount of fluid supplied is within a certain range based on the amount of fluid drained and the amount of fluid supplied provided by both of the aforementioned detection means;

(2) The composition of Claim (1), the automatic transmission fluid replacement apparatus being equipped with a discharged fluid receptacle which stores the used automatic transmission fluid which has been removed via the fluid draining tube; a fresh fluid receptacle which stores the fresh automatic transmission fluid which is compressed and sent from the fluid supply tube which is provided with a means which detects the weight of the used fluid receptacle and at the same time detects the amount of fluid drained from changes in the weight of the fluid draining receptacle by the means which detects the amount of fluid drained; and a means which detects the weight f the fresh fluid receptacle; and detects the amount of fluid supplied by the change in the weight of the fresh fluid receptacle by the means which detects the amount of fresh fluid;

(3) The composition of Claim (1), th automatic transmission fluid replacement apparatus being equipped with a valve means which sets in place a short-circuit line which connects a fluid drainage tube which is located upstream of the control means and a fluid supply tube which is located downstream of the pressurization means in which the outflow pressure of the automatic transmission fluid in the fluid drainage tube [one character illegible] valve which reaches at least normal [pressure] in said short-circuit line is forced to flow to the fluid supply tube side.

3. Detailed Description of Invention

[Field of the Invention]

The present invention relates to an apparatus which replaces the automatic transmission fluid used in the automatic transmission of an automobile and more particularly to an apparatus of the type which replaces the fluid by being connected to the oil cooler or to the automatic transmission fluid line which is connected to the oil cooler.

[Description of the Prior Art]

Prior art examples of this type of apparatus are encountered in [Japanese] Utility Model Publication 62-22718. This means that there have been proposals for an apparatus which connects to the automatic transmission fluid line which is connected to the oil cooler, removes the used automatic transmission fluid discharged from the automatic transmission fluid line as the engine runs and at the same time pressurizes and circulates the fresh automatic transmission fluid to the automatic transmission fluid line and which replaces virtually all of the automatic transmission fluid inside the automobile's transmission.

[Difficulties Which the Present Invention Attempts to Resolve]

Nevertheless, in the prior art apparatus, the flow rate of the used automatic transmission fluid discharged and of the fresh automatic transmission fluid supplied respectively had to be controlled manually which was not only troublesome but required an operator with a certain level of training. What is more, since the amount of automatic transmission fluid discharged fluctuated in accordance with the number of times the engine turned over, there was no means of accurately finding he amount of fluid drained and the amount of fluid supplied. As a result, it caused inconveniences in that it was difficult to balance the amount of fluid drained and the amount of fluid supplied and the level of automatic transmission fluid inside the automobile's transmission during operations was lowered excessively and the automatic transmission fluid overflowed. In particular, wh n the level of the automatic transmission fluid in the automatic transmission was lowered excessively, air got into the fluid, sludge which became

attached and precipitated inside the automatic transmission was lifted up causing strainer to become clogged and ther was the possibility that the function of the automatic transmission would be adversely affected.

[Means Used to Resolve These Problems]

As a result, the present invention attempts to resolve the aforementioned problems by being equipped with a means which connects to the oil cooler of the automobile or to the automatic transmission fluid line which connects to the oil cooler; a fluid drainage tube which removes the used automatic transmission fluid which has flowed in via said fluid drainage means as the engine of the automobile runs; a means which controls the outflow of the used automatic transmission fluid by opening and closing the drainage tube or by controlling the flow rate; a means which detects the amount of used automatic transmission fluid removed from the fluid drainage tube; a fluid supply tube which is provided with a pump or other means of pressurization and circulates under pressure the automatic transmission fluid; a means which detects the amount of fresh automatic transmission fluid circulated under pressure from the fluid supply tube; and a means which controls the aforementioned control means and the aforementioned pressurization device based on the amount of fluid drained and the amount of fluid supplied provided by both of the aforementioned detection means so that the difference between the amount of fluid drained and the amount of fluid supplied is maintained within an indicated range; and which automatically balances the amount of fluid drained and fluid supplied within an indicated range.

The present invention is also capable of replacing the automatic transmission fluid more reliably by a configuration which is provided with a fluid discharge receptacle which stores the used automatic transmission fluid removed in the fluid drainage tube and a means which detects the weight of said fluid discharge receptacle; and which detects the amount of fluid drained by changes in the weight of the fluid drainage receptacle using a means which detects the amount of fluid drained and at the same time is provided with a fresh fluid receptacle which stores fresh automatic transmission fluid which is circulated under pressure from the fluid supply line and with a means which detects the weight of the fresh fluid receptacle; so that the amount of fluid supplied is detected by changes in the weight of the fresh fluid receptacle using a means which detects the amount of fresh oil.

It can be configured so that it sets in place a short-circuiting line which connects the fluid drainage tube which is located upstream of the control device and the fluid supply tube which is located downstream of the pressurization device and is provided with a valve means which opens when the outflow pressure of the automatic transmission fluid in the fluid drainage tube reaches an indicated value in the short-circuiting lin and forces

it to flow to the fluid supply tube so that operations can be carried out mor safely.

Furthermore, in the following practical embodiment of the present invention, the connection means corresponds to fluid drainage hose 2, the control means corresponds to electromagnetic valve 6, the pressurization means corresponds to the pump 8 and the control means corresponds to the control port 20.

[Practical Embodiment of the Invention]

Next, we shall use figures to explain a specific example of the present invention.

Figure 1 is a figure which indicates the configuration of a practical embodiment of the present invention and explains how it is connected. 1 is the automatic fluid transmission device; A is the automatic transmission for which the automatic transmission fluid is replaced by said apparatus 1; B is the engine; and C is the radiator which contains the oil cooler.

Automatic transmission fluid apparatus 1 is connected to automatic transmission fluid line D which is connected to the oil cooler of radiator C via fluid drainage hose 2 and fluid supply hose 3 which are equipped respectively with a connection adaptor. Automatic transmission fluid line D should extend to inlet port C_1 of the oil cooler from automatic transmission fluid outlet port D_1 of the automatic transmission via hose D_2; to automatic transmission fluid inlet port D_4 from outlet port C_2 of the oil cooler via hose D_3; it should interrupt the connection of the line at either of these two locations; the upstream side should be connected to fluid drainage hose 2 and the downstream side should be connected to fluid supply hose 3. Furthermore, fluid supply hose 3 connects a porous nozzle hose to the tip of this and can be set so that this is inserted from automatic transmission filler tube D, thus supplying the fluid.

A fluid drainage tube 4 which connects to the fluid drainage hose 2 and a fluid supply tube 5 which communicates with fluid supply hose 3 is formed inside the automatic transmission fluid apparatus 1. Fluid drainage tube 4 communicates with fluid drainage receptacle 7 via electromagnetic valve 6 and the used automatic transmission fuel which flows into the fluid drainage hose 2 from the aforementioned automatic transmission fluid line D and is eliminated to the waste fluid receptacle 7. Fluid supply tube 5 communicates with fresh fluid receptacle 10 via pump 8 and electromagnetic valve 9; the fresh automatic transmission fluid which is stored in fresh fluid receptacle 10 is pressurized by pump 8 and is circulated by pressurization from the fluid supply hose 3 to the automatic transmission fluid line D.

11 is a short-circuiting line which connects the upstream side of the electromagnetic valve 6 of th fluid drainage tube 4 and the downstream side of the pump 8 on fluid supply tube 5. When the electromagnetic valve 6 is closed and the automatic transmission fluid inflow pressure towards the fluid drainage tube 4 reaches high pressure, the valve is closed, the automatic transmission fluid is circulated to the fluid supply side and is provided with a relief valve 12 which is [two characters illegible].

13 is a second short-circuiting line which connects the upstream side of electromagnetic valve 6 on fluid drainage tube 4 and the upstream side of pump 8 of fluid supply tube 5 and is provided with an electromagnetic valve 14; when the used fluid inside the used fluid receptacle 7 is discarded, electromagnetic valve 14 is opened and pump 8 is driven and the used fluid can be drained from fluid supply hose 3.

Used fluid receptacle 7 and fresh fluid receptacle 10 are loaded respectively on support pedestals 15 and 16. Weight detectors 17 and 18 which are provided with load cells are placed respectively on these support pedestals 15 and 16.

Figure 2 is a block diagram indicating the control group of the aforementioned practical embodiment. 20 is the control board; 21 is the relay board; and 22 is the operating panel.

Control board 20 is provided with an input/output circuit 23, a CPU 23 and a memory 25. Control is outputted from operating panel 22 and weight detectors 17 and 18 to correspond to the input signals in accordance with the program which has been written to memory 25, thus operating the aforementioned pump 8 and electromagnetic valves 6, 9 and 14.

Operating panel 22 is configured of display part 26 and operating input part 27. The display part 26 is equipped with a setting quantity display device 27, a fluid supply quantity display device 28 and a monitor light 29 and are used respectively for displaying as follows.

Set amount display device 27: displays automatic transmission fluid replacement amount which is set by the preset key 30 (to be explained further on).

Fluid supply display device 28: displays amount of fresh automatic transmission fluid supplied in keeping with automatic transmission fluid replacement operations and injection operations using injection key 32 (to be explained further on). Furthermore, when the removal key 33 (to be explained further on) is pressed, the amount of automatic transmission fluid removed is displayed.

Monitor light 29: lights up and indicates when fluid discharge receptacle 7 is full and fresh fluid receptacle 10 is low on fluid

stor d.

Operating and input part 27 is provided with preset key 30, start key 31, injection key 32, removal key 33, used fluid drainage key 34 and stop key 35. These are used respectively in the following operations.

Presetting key 30: sets the amount of automatic transmission fluid replaced while looking at the display of the aforementioned set quantity display device 27 and can be set from lower limit values (4 liters) to upper limit values (12 liters) in increments of 1 liter.

Start key 31: carries out initial input for replacement of the automatic transmission fluid and operates automatically until the set amount of fluid is replaced using the preset key 30 after input. Furthermore, when this is pressed without any setting made by the preset key 30, the standard amount (6 liters) is replaced automatically.

Injection key 32 / removal key 33: after the automatic transmission fluid has been replaced, the level inside the automatic transmission is checked. Based on the results, the automatic transmission fluid is injected and removed. Operations either to inject or remove the fluid using key input are started and these operations are stopped by pressing the stop key 35.

Fluid discharge and drainage key 34: the used fluid inside the fluid drainage receptacle 7 is discharged from fluid supply hose 3, drainage is started by inputting the key and the stop key 35 is pressed so that this drainage operation can be stopped.

Figure 3 is a flow chart indicating operations when the automatic transmission fluid is being replaced as indicated in the aforementioned practical embodiment of the invention. Next, we shall explain how the practical embodiment operates based on the figures.

Fluid drainage hose 2 and fluid supply hose 3 are connected to the automatic transmission fluid line D of the automatic transmission. The engine is started and at the same time, the replacement amount Qp (4 to 12 liters) is set using preset key 30 in the operating panel 22. When start key 31 is pressed, the indicated flow is executed.

First of all, the amount of fluid replaced set by the preset key 30 is read to memory Qp (1). Next, the initial weight of the used fluid receptacle 7 is read from weight detector 17 to memory W_1 and the initial weight of the fresh fluid receptacle 10 is read from the w ight detector 18 to memory W_2 (2).

Here, the estimated weight W_1 + a Qp (a is the specific weight

of the automatic transmission fluid) when replacement operations have been completed is found based on the initial weight W_1 of the used fluid receptacle and the set amount Qp which have been read. A check is made to see whether or not this weight is at or above the weight Wf when the used fluid receptacle 7 is full (3). If it is at or above Wf, the aforementioned monitor shows that the used fluid tank is full and a light comes on indicating that replacement for the set amount cannot be carried out (4), thus completing the flow. In this case, the operator should replace used receptacle 7 or drain the used fluid and carry out the operation a second time.

If there is no likelihood that the used fluid receptacle is full, the estimated weight W_2--a Qp (where a is the specific weight of the automatic transmission fluid) in the fresh fluid receptacle when replacement operations have been completed is found and a check is made (5) to see whether or not this weight is at or less than the weight We when fresh fluid receptacle 10 is empty. If it is at or less than We, the monitor light 29 indicates that there is not enough fresh fluid and the lighted display (10) indicates that the set amount of fluid cannot be replaced and the flow is completed. In this case, the fresh fluid receptacle 10 is filled with fresh fluid or it is replaced with a receptacle which is full of fresh fluid and operations can be started all over again.

When it appears that there is not enough fresh fluid, the pump 8 is driven, electromagnetic valves 6 and 9 open and the fluid replacement operations start (7). In keeping with this, the used automatic transmission fluid inside the automatic transmission flows in from the fluid drainage hose 2 and is stored in the used fluid receptacle 7 and fresh automatic transmission fluid inside the fresh fluid receptacle 10 is circulated at the same time by pressure from fluid supply hose 3.

After the fluid replacement has begun, a reading is made by the weight detector 17 of the present weight of the used fluid receptacle 7 to memory W_1 and a reading is made by weight detector 18 of the present weight of fresh fluid receptacle 10 to memory W_2. The amount of fluid drained ($W_1 - W_1$) removed/a and the amount of fluid supplied ($W_2 - W_2$)/a are found based on these present weights ($W_1 \cdot W_2$) and are [one character illegible] to memories $Q_1 \cdot Q_2$. Of these, the amount of fluid supplied Q_2 is displayed (10) to fluid supply amount display device 28.

Next, based on the amount of fluid drained Q_1 and the amount of fluid supplied Q_2 found, a check is made (11) and (12) to see whether or not the difference between these $Q_1 - Q_2$ either exceeds the indicated value a (0 - 0.5 liters) or is less than the indicated value b (0 --0.5 liters). If it exceeds a, the pump 8 is maintained in operating mode while the electromagnetic valv 6 is closed and the supply of fluid is advanced (13). If it is less than b, pump 8 is stopped with electromagnetic valve 6 open and the drained fluid is advanced (14). In addition, if amount of fluid

drained Q_1 and amount of fluid supplied Q_2 are nearly balanced within an indicated range where $b < Q_1 - Q_2 < 2$, the pump 8 is maintained in operating mode and the electromagnetic valve 6 is maintained in closed valve mode (15). Furthermore, a setting is made so that there is more fluid supplied by the pump 8 than there is of fluid drained when the engine is idling. As a result, step (13) is usually not reached.

When replacement proceeds in this way and the amount of fluid drained Q_1 reaches amount of fluid set Q_p (16), the electromagnetic valve 6 closes (7). When the amount of fluid supplied Q_2 reaches the amount of fluid set Q_p (18), pump 8 is stopped (19). Thus, when it is determined that both the amount of fluid drained Q_1 and the amount of fluid supplied Q_2 amount of fluid set Q_p and replacement has been completed (20), the electromagnetic valve 9 closes as well (21) and the series of operations comes to an end.

After this, the operator checks the level of the automatic transmission fluid in the automatic transmission. After the level has been adjusted by operating the injection key 32 or the removal key 33 as needed, the engine is stopped, the fluid drainage hose 2 and the fluid supply hose 3 are removed, the automatic transmission fluid line is connected as before and the replacement operations are completed.

As a result, according to the practical embodiment of the present invention, by merely connecting the fluid drainage hose 2 and the fluid supply hose 3 to automatic transmission line D and carrying out key input, the set amount of the automatic transmission fluid can be replaced automatically and operations can be easily carried out even by an operator who is unfamiliar with the process without any of the troublesome manual operations which were typical in the prior art. In addition, when the amount of fluid drained and the amount of fluid supplied are constantly monitored and the difference in these deviates from the indicated range, compensating operations are carried out using the operating control of electromagnetic valve 6 or pump 8 so that neither of these is advanced to an extreme. As a result, there is no likelihood of any air becoming mixed in with the automatic transmission fluid in the automatic transmission or of an overflow. Further, the used automatic transmission fluid drained is heated when the engine is driven and is brought to used fluid receptacle 7 in an expanded state. On the other hand, the fresh automatic transmission fluid which is supplied is conveyed at ordinary temperature. As a result, when replacement is carried out so that the amount of volume of both of these is equivalent, fluid is supplied at a level which significantly exceeds the initial level of automatic transmission fluid inside the automatic transmission. Howev r, in the present practical embodiment of the present invention, replacement is made based on the weight data of the weight detectors 17 and 18 so that the same amount can be replaced accurately. In addition, even if the first short-circuiting lin

11 mentioned previously is set in place and electromagnetic valve 6 is closed during the replacement operations and the pressure of the fluid drainage tube 4 and the automatic transmission fluid line D rises, the relief valve 12 opens and the automatic transmission fluid is circulated so that there is no possibility that fatigue will be imparted to any of the tubes by the high pressure or of an overload occurring in the oil pump of the automatic transmission.

[Effectiveness of Invention]

The present invention is configured as indicated above so that it is effective in the following ways.

Regarding Claim (1): the flow rate need not be adjusted manually as was the case in the prior art and operations can be carried out easily. The operator need not have specialized training to operate the apparatus. In addition, the amount of fluid drained and the amount of fluid supplied are maintained equally within an indicated range so that there is no likelihood of any air becoming mixed in with the automatic transmission fluid in the automatic transmission or of any overflow occurring so that replacement operations can be carried out safely and accurately.

Regarding Claim (2): since the amount of fluid drained and the amount of fluid supplied are detected based on their weight, the correct amount can always be replaced accurately without any changes in the volume caused by the temperature.

Regarding Claim (3): even if the fluid drained is restricted by the control means and the tube is subjected to high pressure, these can be resolved by using the short-circuiting line since no fatigue is imparted to the tube and no overload occurs in the oil pump in the automatic transmission and operations can be carried out safely.

4. Brief Explanation of Figures

Figure 1 is a diagram which indicates the configuration of a practical embodiment of the present invention.

Figure 2 is a block diagram indicating how the control system of the same practical embodiment is found.

Figure 3 is a flow chart which indicates how the same practical embodiment operates.

1 is the automatic transmission fluid replacement apparatus. 2 is the fluid drainage hose which is the connection means. 4 is the fluid drainage tube. 5 is the fluid supply tube. 6 is the electromagnetic valve which is the control means. 10 is the fresh fluid rec ptacle. 11 is the short-circuit line. 12 is the relief valve which is the valve means. 17 and 18 are the weight detectors

which ar the weight detection means. 20 is the control board which is the control means. A is th automatic transmission. B is the engine. C is the radiator which contains the oil cooler. D is the automatic fluid transmission line.

Patent Applicant
MK Seiko Co., Ltd.

Amendment of the Proceedings (Voluntary)

September 12, 1988

To the Director-General of the Patent Office

1. **Details of the Case**
   Patent 63-222800 filed on September 6, 1988

2. **Title of Invention**
   Automatic Transmission Fluid Replacement Apparatus

3. **Entity Carrying out Amending**
   Relation to the Case: Patent Applicant

   Name: MK Seiko Co., Ltd.
   Address: 1825 Oaza Yunomiya, Koshoku-shi
   Nagano-ken, Japan
   Representative: Mizuki Maruyama [SEAL] [illegible]

4. **Object of Amendment**
   Specification

5. **Details of the Amendment**
   As indicated on attached sheet [SEAL] [Patent Office
   September 13, 1988
   Second Filing Section]

Specification

1. Title of Invention

Automatic Transmission Fluid Replacement Apparatus

2. Claim

(1) An automatic transmission fluid device which is provided with a means which connects to the oil cooler of an automobile or to the automatic transmission fluid line which is connected to the oil cooler; a fluid drainage tube which removes the used automatic transmission fluid which flows in via said connection means as the engine of the automobile runs; a means which controls the outflow of the used automatic transmission fluid by opening and closing the aforementioned drainage tube or by adjusting the flow rate; a means which detects the amount of used automatic transmission fluid which is removed by the fluid transmission tube; a fluid supply tube which is provided with a pump or other means of pressurization and which circulates the fluid by pressurization from the aforementioned fluid supply tube; and a means which controls the aforementioned control means and the aforementioned pressurization means based on the amount of fluid drained and the amount of fluid supplied by both of the aforementioned control devices;

(2) The composition of Claim (1), the automatic transmission fluid replacement apparatus characterized as having a discharged fluid receptacle which stores used automatic transmission fluid which is has been removed in the fluid drainage tube and a means which detects the weight of the aforementioned discharged fluid receptacle and detects the amount of fluid drained by changes in the weight of the fluid drainage receptacle in the means used to detect the amount of fluid drained; at the same time, it is equipped with a fresh fluid receptacle which stores fresh automatic transmission fluid in the fluid drainage receptacle and the amount of fluid supplied is detected by changes in the weight of the fresh fluid receptacle by the means used to detect the amount of fresh fluid;

(3) The composition of Claim (1), the automatic transmission fluid apparatus being characterized as setting in place a short-circuiting line which connects a fluid drainage tube which is located upstream of the control means and a fluid supply tube which is located upstream of the pressurization means and is equipped with a valve means which closes and forces the fluid to the fluid supply tube side when the outflow pressure of the automatic transmission fluid in the fluid drainage tube reaches or exceeds a certain value.

3. Detailed Explanation of the Invention

[Field of the Invention]

The present invention relates to an apparatus which replaces the automatic transmission fluid which is used in the automatic transmission of automobiles and more particularly to a type of apparatus which replaces the fluid by connecting to the oil cooler or to the automatic transmission fluid line which is connected to the oil cooler.

[Description of the Prior Art]

This type of apparatus has been encountered in the prior art in [Japanese] Utility Model Publication No. 62-22718. This means that there has been a proposal for a device which connects to the automatic transmission fluid which connects to the oil cooler, removes the used automatic transmission fluid which has been drained from the automatic transmission fluid as the engine runs, at the same time circulates the pressurized fresh automatic transmission fluid to the automatic transmission fluid line so that nearly all of the automatic transmission fluid inside the automatic transmission is replaced.

[Problems Which the Present Invention Attempts to Resolve]

Nevertheless, in the prior art apparatus, the flow rate of the used automatic transmission fluid drained and of the automatic transmission fluid supplied had to be controlled manually, and not only were the operations involved in working with it troublesome but the operator required a certain degree of training to work with it. In addition, when the amount of automatic transmission fluid drained fluctuated according to the number of times the engine turned over, there was no means of obtaining an accurate idea of the amount of fluid drained and the amount of fluid supplied. As a result, it was difficult to maintain the balance between the amount of fluid drained and the amount of fluid supplied and it was inconvenient in that the level of the automatic transmission fluid inside the automatic transmission dropped excessively during operations and the automatic transmission fluid overflowed. In particular, when the level of the automatic transmission fluid of the automatic transmission dropped excessively, air got into the automatic transmission fluid, the sludge which had become attached to and precipitated inside the automatic transmission was lifted up, the strainer became clogged and the function of the automatic transmission was adversely affected.

[Means Used to Resolve These Problems]

As a result, the present invention is provided with a means which connects to the oil cooler of an automobile or to the

automatic transmission fluid line which is connected to the oil cooler; a fluid drainage tube which removes the used automatic transmission fluid which flows in via said connection means as the engine of the automobile runs; a means which controls the outflow of the used automatic transmission fluid by opening and closing the aforementioned drainage tube or by adjusting the flow rate; a means which detects the amount of used automatic transmission fluid which is removed by the fluid transmission tube; a fluid supply tube which is provided with a pump or other means of pressurization and which circulates the fluid by pressurization from the aforementioned fluid supply tube; and a means which controls the aforementioned control means, so that the aforementioned pressurization means based on the amount of fluid drained and the amount of fluid supplied by both of the aforementioned control devices automatically balances the amount of fluid drained and the amount of fluid supplied within an indicated range to resolve the aforementioned problems.

Since the present invention is configured so that is has a discharged fluid receptacle which stores used automatic transmission fluid which has been removed in the fluid drainage tube and a means which detects the weight of the aforementioned discharged fluid receptacle and detects the amount of fluid drained by changes in the weight of the fluid drainage receptacle in the means used to detect the amount of fluid drained; at the same time, it is equipped with a fresh fluid receptacle which stores the fresh automatic transmission fluid in the fluid drainage receptacle and the amount of fluid supplied is detected by changes in the weight of the fresh fluid receptacle by the means used to detect the amount of fresh fluid, the fluid can be replaced more accurately.

In addition, it can be configured so that it sets in place a short-circuiting line which connects a fluid drainage tube which is located upstream of the control means and a fluid supply tube which is located upstream of the pressurization means and is equipped with a valve means which closes and forces the fluid to the fluid supply tube side when the outflow pressure of the automatic transmission fluid in the fluid drainage tube reaches or exceeds a certain value and carries out operations more safely.

Furthermore, in the following practical embodiment of the present invention, the connection means corresponds to the fluid drainage hose 2, the adjusting means corresponds to the electromagnetic valve 6, the pressurization means corresponds to the pump 8 and the control means corresponds to the control board 20.

[Practical Embodiment of the Invention]

Next, we shall explain the invention in great r detail using figures.

Figure 1 is an diagram which indicates the configuration of the practical embodiment of the present invention and the invention when it is connected. 1 indicates the automatic transmission fluid replacement apparatus; A indicates the automatic transmission for which the automatic transmission fluid is replaced by apparatus 1; B is the engine; and C is the radiator which contains the oil cooler.

Automatic transmission fluid replacement apparatus 1 is connected to automatic transmission fluid line D which is connected to the oil cooler of radiator C via fluid drainage hose 2 and fluid supply hose 3 which are equipped respectively with a connection adaptor. Automatic transmission fluid line D should reach the inlet port C_1 from the automatic transmission fluid outlet port D_1 of the automatic transmission via hose D_2, it should reach automatic transmission fluid inlet port D_4 on the automatic transmission from the outlet port C_2 of the oil cooler via hose D_3, interrupt the connection of the line at any of these locations and should connect the upstream side to fluid drainage hose 2 and the downstream side to fluid supply hose 3. Furthermore, fluid supply hose 3 can be set so that it connects a porous nozzle hose to the tip of this and can supply the fluid by inserting this from the filler tube E of the automatic transmission.

A fluid drainage tube 4 which communicates with the fluid drainage hose 2 is formed inside the automatic transmission fluid apparatus 1 and a fluid supply tube 5 which communicates with fluid supply hose 3 is likewise formed inside the same apparatus. Fluid drainage tube 4 communicates with fluid drainage receptacle 7 via electromagnetic valve 6 and the used automatic transmission fluid which flows into fluid drainage hose 2 from the aforementioned automatic transmission fluid line D is removed toward used fluid receptacle 7. Fluid supply tube 5 communicates with fresh fluid receptacle 10 via pump 8 and electromagnetic valve 9. Fresh automatic transmission fluid which is stored in fresh fluid receptacle 10 is pressurized by pump 8 and is circulated to automatic transmission fluid line D from fluid supply hose 3.

11 is the first short-circuiting line which connects the electromagnetic valve 6 of fluid drainage tube 4 on the upstream side and the pump 8 of the fluid supply tube 5 on the downstream side. It is provided with a relief valve 12. When the electromagnetic valve 6 closes and the automatic transmission fluid inflow pressure towards the fluid drainage tube 4 reaches a pressure which is higher than ordinary pressure, the valve opens and this relief valve circulates the automatic transmission fluid to the fluid supply side and relief valve 12.

13 is a second short-circuiting line which connects the electromagnetic valv 6 of the fluid drainage tube 4 on th upstream side and the pump 8 of the fluid supply tube 5 on the upstream [sic] side and is equipped with an electromagnetic valve

14. When used fluid inside the used fluid receptacle 7 is discard d, electromagnetic valve 14 opens and pump 8 is driven and the used fluid is drained from the fluid supply hose 3.

Used fluid receptacle 7 and fresh fluid receptacle 10 are loaded respectively on support pedestals 15 and 16. Weight detectors 17 and 18 which are provided respectively with load cells are located on the support part of these support pedestals 15 and 16.

Figure 2 is a block diagram which indicates the control system in the aforementioned practical embodiment of the invention. 20 is an adjustment board; 21 is a relay board and 22 is an operating panel.

Control board 20 is provided with an input/output circuit 23, a CPU 24 and a memory 25. Control is outputted in accordance with the input signals from operating panel 22 and weight detectors 17 and 18 to relay board 21 according to the program written in memory 25 and the aforementioned pump 8 and each of the electromagnetic valves 6, 9 and 14 are activated.

Operating panel 22 is made up of a display part 26 and an operating and input part 27. The display part 26 is provided with a setting amount display part 27, a fluid supply amount display part 28 and a monitor light 29. These are used for displaying as follows.

Setting amount display 27: this displays the amount of automatic transmission fluid replaced which is set by the preset key 30 (to be explained further on).

Fluid supply amount display 28: this displays the amount of fresh automatic transmission fluid which has been supplied in accordance with the injection operations carried out in the automatic transmission fluid replacement operations and by injection key 32 (to be explained further on). Furthermore, when removal key 33 (to be explained further on) is pressed, the amount of automatic transmission fluid removed is displayed.

Monitor light 29: this lights up when used fluid receptacle 27 is full and when there is not enough fluid stored in the fresh fluid receptacle 10.

The operating and input part 27 is provided with a preset key 30, a start key 31, an injection key 32, a removal key 33, a used fluid discharge key 34 and a stop key 35. These are used respectively for operations as follows.

Pr set key 30: this sets the amount of automatic transmission fluid replaced while looking at the display of the aforementioned setting amount display device 27. It can be set in 1 liter

increments ranging from a lower limit value (4 liters) to an upper limit value (12 liters).

Start key 31: this carries out initial input for replacing the automatic transmission fluid and operates automatically until the replacement is made in the amount set by the preset key 30 after input. Furthermore, when this is pressed without any setting being made by the preset key 30, the standard amount (6 liters) of fluid is replaced automatically.

Injection key 32 / removal key 33: after the automatic transmission fluid has been replaced, the level inside the automatic transmission is checked and the automatic transmission fluid is injected and removed based on the results. Operations for injection or removal are started through inputting using the key and these operations can be brought to a halt by pressing the stop key.

Used fluid drained key 34: this drains the used fluid inside the fluid drainage receptacle 7, starts the drainage by key input and can stop the drainage operation by pressing the stop key 35.

Figure 3 is a flow chart which indicates operations when the automatic transmission fluid is replaced according to the aforementioned practical embodiment of the present invention and indicates the operations for the practical embodiment based on this figure as follows.

Fluid drainage hose 2 and fluid supply hose 3 are connected to the automatic transmission fluid line D of the automatic transmission. When the engine is started and replacement amount Q_p (4 to 12 liters) is set using the preset set key 30 on operating panel 22, the indicated flow is executed by pressing the start key 31.

First, the amount of fluid replaced set by preset key 30 is read to memory Q_p (1). Next, the initial weight of the used fluid receptacle 7 is read to memory W_1 by weight detector 17 and the initial weight of the fresh fluid receptacle 10 is read to memory W_2 by weight detector 18 (2).

Here, the estimated weight W_1 + a Qp (where a is the specific weight of the automatic transmission fluid) of the used fluid receptacle when replacement operations have been completed is found based on the initial weight W_1 of the used fluid receptacle and the set amount Q_p which have been read. A check is made to see whether or not this weight is at or above the weight Wf when the used fluid receptacle 7 is full (3). If it is at or above Wf, the aforementioned monitor light lights up (4) indicating that the used fluid receptacle is full and that the set amount cannot b replaced and the flow comes to an end. In this case, the operator should replace the fluid in used fluid r ceptacle 7 or drain the used

fluid and carry out input operations a second time.

If there is any likelihood that the used fluid [receptacle] is full, the estimated weight $W_2 - a W_p$ (where a is the specific weight of the automatic transmission fluid) of the fresh fluid receptacle when replacement has been completed is found. A check is made (5) to see whether or not this weight is at or below weight W_e when fresh fluid receptacle 10 is empty. If it is at or below W_e, the monitor light 29 lights up indicating that there is not enough fresh fluid and that the set amount cannot be replaced (6) and the flow comes to an end. In this case, fresh fluid should be either added to the fresh fluid receptacle 10 or it is replaced with a receptacle filled with fresh fluid and operations should be started all over again.

When it is seen that there is no likelihood that the fresh fluid is insufficient, pump 8 is driven, electromagnetic valves 6 and 9 are opened and the replacement operations begin (7). In keeping with this, the used automatic transmission fluid inside the automatic transmission flows in from the fluid draining hose 2 and is stored in used fluid receptacle 7. At the same time, the fresh automatic transmission fluid inside the fresh fluid receptacle 10 is pressurized and circulated.

After replacement has begun, the present weight of the used fluid receptacle 7 is read to memory w_1 by weight detector 17 and the present weight of the fresh fluid receptacle 10 is read to memory w_2 by weight detector 18 (8). Based on these weights w_1 and w_2, the amount of drained fluid $(w_1 - W_1)/a$ removed and the amount of fluid supplied $(W_2 - w_2)/a$ is found and stored respectively in memories Q_1 and Q_2 (9). Of these, the amount of fluid supplied Q_2 is displayed to fluid supply amount display device 28 (10).

Next, based on the amount of fluid drained Q_1 and the amount of fluid supplied Q_2, a check is made (11) and (12) to see whether the difference $Q_1 - Q_2$ exceeds the indicated value a (0 - 0.5 liters) or if it is less than the indicated value b (0 - -0.5 liters). If it is greater than a, pump 8 is maintained in operating mode while electromagnetic valve 6 is closed and the fluid supply is advanced (13). If it is less than b, pump 8 stops while electromagnetic valve 6 is open and the drained fluid is advanced (14). In addition, if the amount of fluid drained Q_1 and the amount of fluid supplied Q_2 is nearly balanced in the indicated range of $b < Q_1 - Q_2 < a$, the pump 8 is maintained in operating mode and the electromagnetic valve 6 remains open (15). Furthermore, it is set so that the amount of fluid supplied by the pump 8 is greater than the amount of fluid drained while the engine is idling so that normally one does not go on to step (13).

Thus, when replacement proceeds and the amount of fluid drained Q_1 reaches the amount set Q_p (16), the electromagnetic valve 6 closes (17). In addition, when the amount of fluid supplied Q_2

reaches the amount of fluid set Q_p (18), the pump 8 is stopped (19). Thus, when it is determined that both the amount of fluid drained Q_1 and the amount of fluid supplied Q_2 reaches set amount Q_p and the replacement operations are completed (20), electromagnetic valve 9 closes as well (21) and the series of operations comes to an end.

Then, the operator checks the level of the automatic transmission fluid in the automatic transmission and adjusts the level by activating the injection key 32 if needed or by activating the removal key 33. Then, the engine stops, the fluid drainage hose 2 and the fluid supply hose 3 are removed, the automatic transmission fluid line is returned to normal and the replacement operations are completed.

As a result, according to the process of the practical embodiment of the present invention, the fluid drainage hose 2 and the fluid supply hose 3 are connected to automatic transmission line D. By merely carrying out key input, the set amount of automatic transmission fluid can be replaced automatically and the operations can be completed easily even by an operator with no special training without any of the troublesome manual operations that were typical of the prior art. In addition, when the amount of fluid drained and the amount of fluid supplied are constantly monitored and the difference between these deviates from the indicated range, compensating operations are carried out by adjusting the electromagnetic valve 6 or the pump 8 so that neither of these is advanced to an extreme. As a result, there is no likelihood of air becoming mixed into the automatic transmission fluid in the automatic transmission or of an overflow occurring. What is more, the used automatic transmission fluid which has been drained is heated when the engine is driven and is brought to the used fluid receptacle 7 while it is expanded whereas the fresh automatic transmission fluid which has been supplied is conveyed at ordinary temperature. As a result, when replacement is made so that the volume of both of these is equivalent, fluid is supplied at a level which significantly exceeds the level of the initial automatic transmission fluid inside the automatic transmission. However, in the practical embodiment of the present invention, the fluid is replaced based on the weight data by the weight amount detectors 17 and 18 so that the same amount of fluid can be replaced correctly. In addition, even if the aforementioned first short-circuiting line is set in place and electromagnetic valve 6 is closed during operations and the pressure in the fluid drainage tube 4 and the automatic transmission fluid line D rises, relief valve 12 opens and the automatic transmission fluid is circulated. As a result, there is no likelihood that fatigue will be imparted to any of the tubes by the high pressure or that a overload will be imparted to th oil pump of the automatic transmission.

Furthermore, the practical embodiment of the present invention is provided with an electromagnetic valve 6 as an adjustment means,

fluid drainage tube 4 is opens and closes and the fluid drained is adjusted. However, when the amount of fluid drained xceeds the amount of fluid supplied, an adjustment may be made using the adjustment means as a flow rate control valve so that this control valve can be closed tightly. In addition, when pump 8 which is a pressurization means has a capacity in which the fluid supply velocity is always greater than the fluid drainage velocity, the adjustment means only opens and closes the tube at the beginning and at the end of the replacement operations and can be adjusted so that the balance between the fluid supplied and the fluid drained is adjusted by turning the pump 8 on and off. Meanwhile, when the apparatus is configured so that the capacity of the pump 8 is low and the fluid drained precedes the fluid supplied, pump 8 runs continuously during the replacement operations and can be adjusted so that the balance between the fluid supplied and the fluid drained is maintained only by adjusting the fluid drained in the adjustment means.

[Effectiveness of Invention]

The present invention is configured as indicated above and is effective in the following ways.

Regarding Claim (1): operations are simple without any need for adjusting the flow rate using the manual operations which were typical of the prior art and the operator requires no specialized training. In addition, the amount of fluid drained and the amount of fluid supplied can be balanced within the indicated range and there is no likelihood that any air will become mixed in with the automatic transmission fluid in the automatic transmission or that there will be an overflow so that replacement operations can be carried out safely and accurately.

Regarding Claim (2): the amount of fluid drained and the amount of fluid supplied is detected based on the weight of these so that the amount can always be replaced accurately without any adverse effects on changes in the volume brought about by the temperature.

Regarding Claim (3): even if the fluid drained by the adjustment means is restricted and the pressure inside the tube is high, this can be resolved by using the short-circuiting line so that replacement operations can be carried out safely without causing fatigue to the tube or adding an overload to the oil pump of the automatic transmission.

4. Brief Explanation of Figures

Figure 1 is a diagram which indicates a practical embodiment of the present invention.

Figure 2 is a block diagram in which the adjustment system of the same practical embodiment is found.

Figure 3 is a flow chart which indicates the operation of the same practical embodiment.

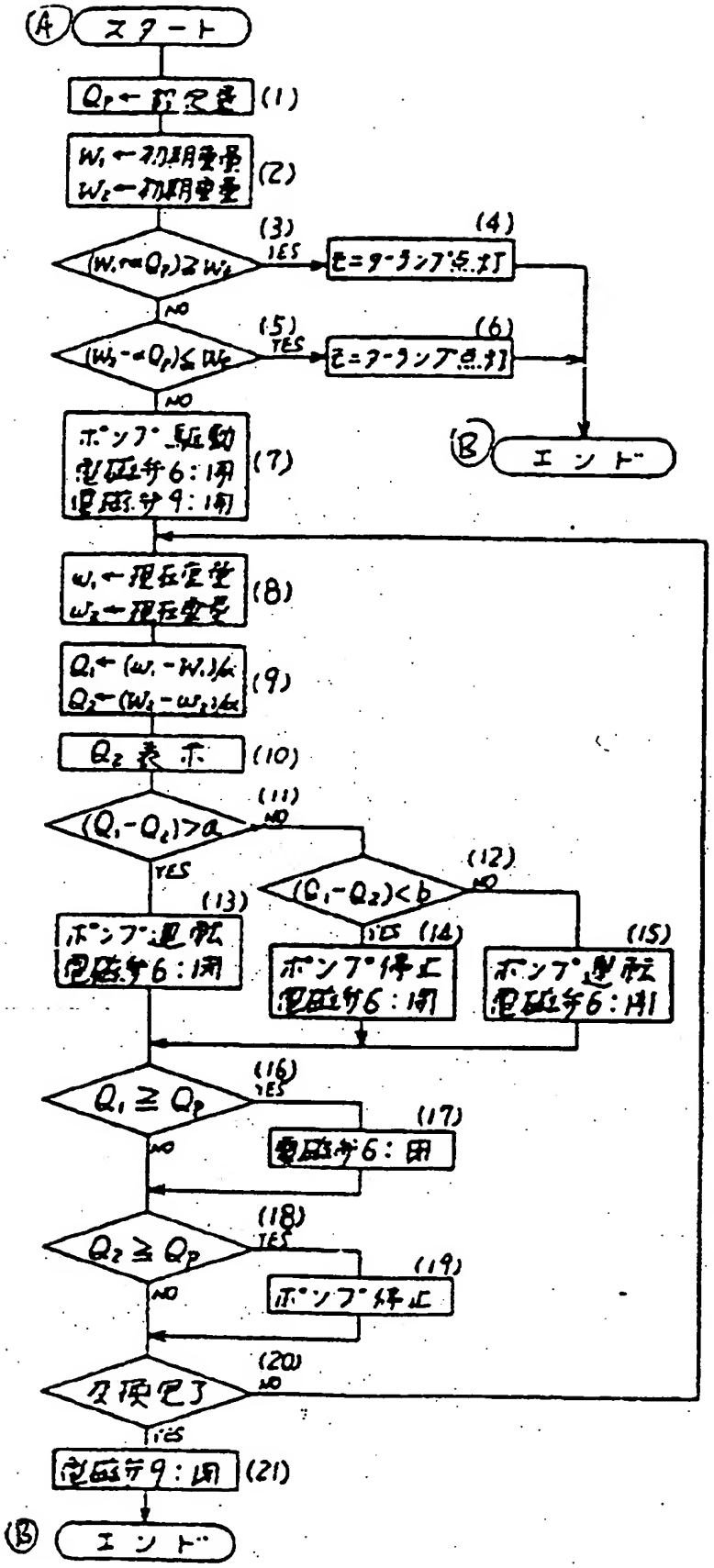
1 is the automatic transmission fluid replacement apparatus. 2 is the fluid drainage hose which is the connection means; 4 is the fluid drainage tube; 5 is the fluid supply tube; 6 is the electromagnetic valve which is the adjustment means; 7 is the fluid drainage receptacle; 8 is the pump which is the pressurization means; 10 is the fresh fluid receptacle; 11 is the short-circuiting line; 12 is the relief valve which is the valve means; and 20 is the control board which is the control means. A is the automatic transmission; B is the engine; C is the radiator which contains the oil cooler; and D is the automatic transmission fluid line.

Patent Applicant M.K. Seiko, Ltd.

Key-ins from page 6 of original Japanese document
Figure 2
1. [illegible]; 2. [illegible]; 3. [illegible]. 4. [illegible]; 5. [illegible]; 6. Start; 7. Injection; 8. [illegible]; 9. [illegible]; 10. Stop.

Key-ins from page 714 of original Japanese document
Figure 3
A. Start; B. End; (1) Qp--set amount; (2) W_2--initial weight; W_2--initial weight; (4) Monitor light lights up; (6) Monitor light lights up; (7) Pump driven; electromagnetic valve 6 opens; electromagnetic valve 9 opens; (8) W_1--present weight; W_2--present weight; (10) Q_2 display; (13) Pump operates; electromagnetic valve 6 closes; (14) pump stops; electromagnetic valve 6 opens; (15) pump runs; electromagnetic valve 6 opens; (17) electromagnetic valve 6 opens; (19) pump stops; (20) replacement operations completed; (21) electromagnetic valve 9 closes.

第 3 図


Ⓐ スタート
Q_p ← 設定量 (1)
W_1 ← 初期重量
W_2 ← 初期重量 (2)
$(W_1 - Q_p) \geq W_2$ (3) YES
エラーランプ点灯 (4)
NO
$(W_1 - Q_p) \leq W_2$ (5) YES
エラーランプ点灯 (6)
NO
ポンプ駆動
電磁弁6：開
電磁弁9：閉 (7)
Ⓑ エンド
W_1 ← 現在重量
W_2 ← 現在重量 (8)
$Q_1 \leftarrow (W_1 - W_1)/k$
$Q_2 \leftarrow (W_1 - W_2)/k$ (9)
Q_2 表示 (10)
$(Q_1 - Q_2) > a$ (11) NO
YES
$(Q_1 - Q_2) < b$ (12) NO
YES (14)
(13)
ポンプ運転
電磁弁6：閉
ポンプ停止
電磁弁6：閉
(15)
ポンプ運転
電磁弁6：開
$Q_1 \geq Q_p$ (16) YES
NO
電磁弁6：開 (17)
$Q_2 \geq Q_p$ (18) YES
NO
ポンプ停止 (19)
処理完了 (20) NO
YES
電磁弁9：開 (21)
Ⓑ エンド

第 2 図